

CLAIMS

1. A zebrafish cytokeratin gene promoter which is capable of directing a structural gene to be predominantly expressed in skin epithelia when it is inserted in front of the structural gene and introduced into fish embryos.
2. A zebrafish muscle creatine kinase gene promoter which is capable of directing a structural gene to be specifically expressed in muscles when it is inserted in front of the structural gene and introduced into fish embryos.
3. A zebrafish fast skeletal muscle isoform of myosin light chain 2 gene promoter which is capable of directing a structural gene to be predominantly expressed in skeletal muscles when it is inserted in front of the structural gene and introduced into fish embryos.
4. A zebrafish acidic ribosomal protein P0 gene promoter which is capable of directing a structural gene to be expressed ubiquitously in all tissues when it is inserted in front of the structural gene and introduced into fish embryos.
5. A recombinant DNA molecule comprising a structural gene and the promoter of claim 1, 2, 3 or 4 arranged upstream of said structural gene.
6. A chimeric gene comprising the promoter of claim 1, 2, 3 or 4, operatively linked to DNA encoding a protein selected from the group consisting of GFP, modified GFP, EGFP, BFP, EBFP, YFP, EYFP, CFP, ECFP, luciferase, β -galactosidase, chloramphenicol acetyltransferase, and growth hormone.
7. A transgenic fish comprising a chimeric gene comprising the promoter of claim 1, 2, 3 or 4.
8. The transgenic fish of claim 7, which contains said promoter in germ cells and/or in somatic cells and which is capable of breeding with either a said transgenic fish or a non-transgenic fish to produce viable and fertile transgenic progeny.
9. The transgenic fish of claim 7, and progeny of said fish that emits green fluorescence when the whole fish is exposed to a blue or ultraviolet light.
10. A transgenic fish comprising a DNA that encodes a fluorescent protein under control of a promoter that causes said DNA (1) to be expressed in predominately

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skin epithelia, (2) to be specifically expressed in muscles, (3) to be predominantly expressed in skeletal muscles, or (4) to be expressed ubiquitously in all tissues.

— 11. The transgenic fish of claim 8, wherein said fluorescent protein is expressed a level sufficient that said fish fluoresces upon exposure to sunlight or daylight.

5 12. The transgenic fish of claim 11, wherein said high expression is induced by exposure of said fish to a steroid compound or to a heavy metal.

13. The transgenic fish of claim 10, wherein said promoter is a promoter which naturally occurs in the genome of a fish of the same species as the transgenic fish.

10 14. A recombinant DNA vector comprising a promoter DNA that hybridizes under stringent conditions to a polynucleotide of any one of SEQ ID NOS:7, 8, 9, or 22, operatively linked to a structural gene encoding a fluorescent or chemiluminescent protein.

15. A cell transformed with the vector of claim 14.

15 16. A transgenic fish comprising a chimeric gene in turn comprising a promoter DNA that hybridizes under stringent conditions to a polynucleotide of any one of SEQ ID NOS:7, 8, 9, or 22, operatively linked to a structural gene encoding a fluorescent or a chemiluminescent protein.

17. A method for sensing a steroid hormone or a steroid hormone derivative in a water sample comprising:

20 (a) contacting a fish expressing a fluorescent or chemiluminescent protein under control of an estrogen- or other steroid hormone-inducible promoter with a sample of water; and

(b) measuring the amount of fluorescent or chemiluminescent light from said fish.

25 18. A method for sensing heavy metals, such as zinc, copper, cadmium, mercury etc., in a water sample comprising:

(a) contacting a fish expressing a fluorescent or chemiluminescent protein under control of a heavy metal-inducible promoter with a sample of water; and

(b) measuring the amount of fluorescent or chemiluminescent light from said fish.

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